# Operating instructions Digital handheld pressure gauge

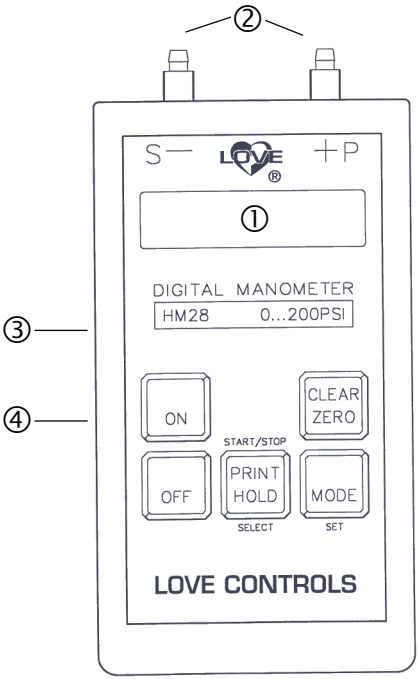
# HM28

## Contents

# Operating instructions

ON = On
OFF = Off
MODE = Select operating mode
- Pressure measurement
- Min./Max.
- Leak rate
- Datalogging

CLEAR/ZERO = Zero setting
PRINT/HOLD = Print and freeze display
START/STOP = Data recording / printing
SET = Select config. modes
SELECT = Select config. data




① Matrix display
② Connection for pneumatic hoses
③ Connection for plug-in power supply unit
④ Connection for RS 232 interface

**Important!**

**Please note warning symbol in the operating instructions.**

## 1 Description

The „LOVE CONTROLS“ handheld pressure gauge HM28 is a digital pressure measuring instrument with integrated pressure sensor for the measurement of differential, relative or absolute pressures and vacuum. Its versatile range of functions and high precision makes it suitable for a wide range of applications.

Configuration possibilities:

- Autom. switching off, selectable time
- Selectable resolution and damping
- Selectable units of time
- Selectable measurement units
- General reset to standard setting
- Selectable data transfer rate
- Configuration printout
- Selectable measuring intervals

## 2 Safety details

The pressure values stated on the rating plate and mentioned in these operating instructions must not be exceeded otherwise the pressure sensor can be destroyed.

**Do not use the instrument in danger zones (explosives zones)!**
**Wear eye protection for pressures > 1bar!**

## 3 Operating

### 3.1 Switching on and off

**Switching on** Press the ON key (the maximum permissible measuring range and the class appears on the display).
For precision measurements the instrument must be switched on for at least 1 minute (warm-up phase).

**Switching off** Press the OFF key, or automatic switching off 1,10 or 60 min after the last keystroke.

In case of a temperature change the instrument requires at least 30 minutes to adjust to the new ambient temperature.

### 3.2 Pneumatic connection

For measuring ranges up to 7000 mbar, 4/6 mm or NPT 1/8" connectors can be connected depending on model. Higher ranges are equipped with NPT 1/8".

Ensure correct connection of the pneumatic hoses!

**+P** high pressure
**S-** low pressure (not available with the absolute and relative pressure version)

Measuring negative differential or relative pressures:

connect “**S-**” ➔ negative pressure,
or
change ports “**S-**“ and “**+P**”.

The HM28 will display a positive value.

**When screwing on a coupling it is important to hold with a spanner in the opposite direction. Never hold at case only!**

### 3.3 Operating modes

The modes in the matrix below can be selected in succession by pressing the MODE key.

After switching ON, the instrument is **always in the mode „normal“**.

|  |  |  | **Display example** | **Notes** |
|---|---|---|---|---|
| Switching on | | | Max. Range:<br>200 mbar | Measuring range displayed in desired unit |
| | | | Full scale error<br>0.05 % | Accuracy class as a % of full scale reading |
| Normal (differential) and analogue/hold | print<br>hold | zero<br>display | 123.45 mbar<br>====== or<br>HLD 123.4 mbar | **Only with differential or relative pressure models**<br>Hold, store indicated value |
| Normal (absolute) and differential | print | zero<br>diff | 1013.2 mbar<br>DIF 1013.2 mbar | **Only with absolute pressure mode** Zero sets Diff to 0 |
| Zoom | print | zero<br>display | 123.45 | Measurement in large figures |
| Min/Max | print | zero<br>(reset) | MAX 150.0 mbar<br>MIN 100.0 mbar | With absolute pressure, reset to actual value |
| Leak rate | print | zero<br>display | 1234.5 mbar<br>LEK 2.1 /min | **Only with Diff./Rel.** (unit/time unit) |
| Tendency (absolute) | print | | 1013.2 mbar<br>TND - 15.7 /min | **Only with absolute pressure** (unit/time unit) |
| Record 1) | start/stop | clear<br>memory | REC 432.1 mbar<br>STOP 30 s MEM 1 | If measurement memory cleared |
| | | | REC 432.1 mbar<br>RUN 30 s MEM 321 | Recording runs up to 964 values |
| | | | 432.1 mbar<br>STOP 30 s MEM 901 | Recording stopped |
| Print Record | print<br>quick keystroke: max. output speed<br>Keystroke approx.1s: single or fast output start/stop printing | | PRINT RECORD<br>PUSH PRINT<br>PRT 432.1 mbar<br>321 00:13:30<br>PRT<br>Record stopped | Appears only if values are stored<br>Printing / display with time<br>Recording stopped |

1) at 70 bar the measurements are stored in [bar]

## 3.4 Configuration

Select mode:
Press  >2 seconds ➔ on the display appears CONFIGURATION

Store and exit:
Press  >2 seconds ➔ on the display appears SAVE CONFIGURATION

|  |  |  | **Display example** | **Notes** |
|---|---|---|---|---|
| set unit | **mbar**, kPa, bar, 2) $mmH_2O$, $mH_2O$, mmHg, psi, $inH_2O$, inHg, hPa, Pa, MPa | | UNIT<br>mbar | |
| set resolution 1) | **high**<br>low | | RESOLUTION<br>high | Display resolution, influences measuring rate in RS 232 mode |
| set damping | **off**<br>on | | DAMPING<br>off | 90% recovery after 4 measurements (when ON) |
| set baudrate | **9600**, 4800, 2400, 1200 | | BAUDRATE<br>9600 | |
| set auto-off continuous | 1, **10**, 60 min<br>continue | | AUTO OFF<br>10 min | Automatic switching off or continuous mode |
| set time unit hours | **minutes**<br>hours | | TIME UNIT<br>minutes | For leak rate, tendency |
| set Rec. interval 1) | 1, **5**, 10, 20, 30, 60 s<br>2, 3, 5, 10, 30, 60 min<br>manual, off | | REC INTERVAL<br>5 s (1.3h) | Off = record mode is deactivated<br>(max. record interval) |
| set display rate | **2.5 Hz** (400 ms)<br>5 Hz (200 ms) | | DISPLAY RATE<br>2.5 Hz (400 ms) | Normal mode indication/zoom (influences DAMPING) |
| general reset? | set on default values | zero | GENERAL RESET?<br>PUSH ZERO | Reset all settings and clear measurement memory |
| | | | GENERAL RESET?<br>RESET OK | After actuating ZERO |
| print configuration? | print now | | PRINT CONFIG?<br>PUSH PRINT | Unit, ... |
| | | | PRINT CONFIG?<br>PRINTING | After actuating PRINT |

1) If changed, the measurement memory is cleared 2) See in 4.1 "Technical data"

## 3.5 RS 232 mode

The HM28 can be remotely operated from a personal computer via an RS 232 interface. The automatic switching off (chapter 3.1) is inactive. Connection by means of a RS232-cable.

**Plug pin assignment** RS 232, DB 9 (female)

| Pin | Assignment | Pin | Assignment |
|---|---|---|---|
| 1 | DCD | 6 | DSR |
| 2 | TXD | 7 | RTS |
| 3 | RXD | 8 | CTS |
| 4 | DTR | 9 | SHIELD |
| 5 | GND | | |

**Protocol**
ASCII-commands
9600/4800/2400/1200 baud, 8 bit, no parity, 1 stop bit,
XON/XOFF - protocol (17 dec/19 dec)

**Notes**

- The HM28 is switched on when the supply voltage is applied
- The HM28 sends "XON" every 3 seconds To determine the baud rate, read-in "XON" in each transfer rate until "XON" is correctly identified
- To go to remote control mode, interrogate "XON", immediately send the "remote" command and then read-in the acknowledgement "ok"
- Only lower case letters are accepted
- Observe > 0,1 s delay before the next command after "setbaud" command
- To acknowledge the answer of the HM28 without reading it back, just send a "XON"
- The symbol "*" followed by the checksum must be suffixed to each string. The string must be terminated with a CR
- A "TAB" is prefixed to each answer of the HM28, a "*" suffixed and the checksum sent.

The answer is terminated with a CR

- The checksum is formed from the least significant byte of the command string

**Code-decoding of control command «readconfig»**

| Code | Configuration |
|---|---|
| **Pressure unit** | |
| 5 | MPa(7-70bar) |
| 6 | Pa(25mbar-7bar) |
| 7 | kPa |
| 8 | bar |
| 9 | mH2O(with 70bar, otherwise mmH2O) |
| 10 | mmHg(not with 70bar) |
| 11 | psi |
| 12 | inH2O |
| 13 | inHg (not with 70bar) |
| 14 | hPa |
| 15 | mbar |
| **Resolution** | |
| 0 | low |
| 1 | high |
| **Damping** | |
| 0 | on |
| 1 | off |
| **Baudrate** | |
| 0 | 1200 Baud |
| 1 | 2400 Baud |
| 2 | 4800 Baud |
| 3 | 9600 Baud |

| Code | Configuration |
|---|---|
| **Switch. off time** | |
| 0 | 60 min |
| 1 | continous |
| 2 | 1 min |
| 3 | 10 min |
| **Time unit** | |
| 0 | /hours |
| 1 | /minutes |
| **Storage interval** | |
| 2 | 10 s |
| 3 | 20 s |
| 4 | 30 s |
| 5 | 60 s |
| 6 | 2 min |
| 7 | 3 min |
| 8 | 5 min |
| 9 | 10 min |
| 10 | 30 min |
| 11 | 60 min |
| 12 | manual |
| 13 | off |
| 14 | 1 s |
| 15 | 5 s |
| **Display rate** | |
| 0 | 5 Hz |
| 1 | 2.5 Hz |

**Reply to control command «readconfig»**

A whole number is returned as a reply

```
msb                  lsb
 #### #### #### ####
 |||| |||| |||| ****-Pressure unit
 |||| |||| |||*------Resolution
 |||| |||| ||*-------Damping
 |||| |||| **--------Baudrate
 |||| ||**-----------Switching off time
 |||| |*------------Time unit
 |***-*-------------Storage interval
 *------------------Display rate
```

| Control commands/syntax | | | | Answer from HM28/syntax | | | | | | | | | Description |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| remote | * | 182 | CR | (tab)[ok] | | | | | | * | 13 | CR | Switch to remote control and block keypad |
| local | * | 53 | CR | (tab)[ok] | | | | | | * | 13 | CR | Switch to keypad |
| off | * | 101 | CR | (tab)[ok] | | | | | | * | 13 | CR | Switch off instrument |
| readpress | * | 243 | CR | (tab)"Value" | _ | "Unit" | * | Checksum | | | | CR | Interrogate measurement |
| readpressfast | * | 161 | CR | (tab)"Value" | * | Checksum | CR | (tab)"Value" | * | Checksum | | CR | Fast measurement interrogation "RESOLUTION high" output10 M/s "RESOLUTION low" output 20 M/s |
| $ | | | | (tab)[ok] | | | * | 13 | | | | CR | Exit "readpressfast" mode following send "XON" |
| readrange | * | 211 | CR | (tab)"Range" | _ | "Unit" | * | Checksum | | | | CR | Interrogate measuring range |
| readbat | * | 253 | CR | (tab)"full"/"empty" | * | 230/98 | | | | | | CR | Interrogate battery capacity (lobat) (full=ok, empty=change) |
| readrecord | * | 69 | CR | (tab)"Recinterval" | _ | (tab)"Value" | _ | (tab)"Value" | _ | (tab)"Value" | | | Interrogate stored measured |
| | | | | (tab)[record_stopped] | | | | | | * | 200 | CR | Recording is stopped |
| | | | | (tab)[out_of_range] | | | | | | * | 164 | CR | Measurement out of range |
| | | | | (tab)[record_end] | | | | | | * | 0 | CR | Recording stopped (waits at "XON" and sends back "ok" ) |
| readtemp | * | 124 | CR | (tab)"Value" | _ | °C | * | Checksum | | | | CR | Interrogate internal temperature, ±4 °C (±39 °F) |
| clearmem | * | 112 | CR | (tab)[ok] | | | | | | * | 13 | CR | Clear datalogging memory |
| readconfig | * | 60 | CR | (tab)Code (see decoding in table page 17) | | | | | | * | Checksum | CR | Readout actual configuration |
| setzero | * | 54 | CR | (tab)[ok] | | | | | | * | 13 | CR | Zero indication |
| setdefault | * | 91 | CR | (tab)[ok] | | | | | | * | 13 | CR | Reset all settings and clear memory, change to keypad |
| setunit_kpa<br>setunit_mbar<br>setunit_bar | *<br>*<br>* | 146<br>248<br>139 | CR | (tab)[ok] | | | | | | * | 13 | CR | Corresponding units<br>see 4.1 Technical data |

| Control commands/syntax | | | | Answer from HM28/syntax | | | | Description |
|---|---|---|---|---|---|---|---|---|
| setunit_mmh2o | * | 57 | | | | | | |
| setunit_mmhg | * | 255 | | | | | | |
| setunit_psi | * | 162 | | | | | | |
| setunit_inh2o | * | 54 | | | | | | |
| setunit_inhg | * | 252 | | | | | | |
| setunit_hpa | * | 143 | | | | | | |
| setunit_pa | * | 39 | | | | | | |
| setunit_mpa | * | 148 | | | | | | |
| setbaud_9600 | * | 1 | CR | (tab)[ok] | * | 13 | CR | Select baud rate (answer with new baud rate, wait >0,1s before "XON") |
| setbaud_4800 | * | 254 | | | | | | |
| setbaud_2400 | * | 248 | | | | | | |
| setbaud_1200 | * | 245 | | | | | | |
| resolution_high | * | 62 | CR | (tab)[ok] | * | 13 | CR | Select measurement resolution and indication, high:10 M/s, low: 20 M/s |
| resolution_low | * | 240 | | | | | | |
| settempmode_0 | * | 33 | CR | (tab)[ok] | * | 13 | CR | Temp. measuring will be switched off at RS232 mode |
| settempmode_1 | * | 34 | | | | | | Temp. measuring will be done periodically (default value) |
| setrecint_off | * | 86 | CR | (tab)ok | * | 13 | CR | Select storage interval (secondes) |
| setrecint_man | * | 87 | | (tab)ok | | | | |
| setrecint_1 | * | 76 | | (tab)ok | | | | |
| setrecint_5 | * | 80 | | (tab)ok | | | | |
| setrecint_10 | * | 124 | | (tab)ok | | | | |
| setrecint_20 | * | 125 | | (tab)ok | | | | |
| setrecint_30 | * | 126 | | (tab)ok | | | | |
| setrecint_60 | * | 129 | | (tab)ok | | | | |
| setrecint_2m | * | 186 | | (tab)ok | | | | Select storage interval (minutes) |
| setrecint_3m | * | 187 | | (tab)ok | | | | |
| setrecint_5m | * | 189 | | (tab)ok | | | | |
| setrecint_10m | * | 233 | | (tab)ok | | | | |

| Control commands/syntax | | | | Answer from HM28/syntax | | | | Description |
|---|---|---|---|---|---|---|---|---|
| setrecint_30m | * | 235 | CR | (tab)ok | * | 13 | CR | |
| setrecint_60m | * | 238 | | (tab)ok | | | | |
| setautooff_man | * | 198 | CR | (tab)ok | * | 13 | CR | Select autom. switching off time (minutes) |
| setautooff_1 | * | 187 | | (tab)ok | | | | |
| setautooff_10 | * | 235 | | (tab)ok | | | | |
| setautooff_60 | * | 240 | | (tab)ok | | | | |
| setdamp_off | * | 115 | CR | (tab)ok | * | 13 | CR | Damping off |
| setdamp_on | * | 21 | | (tab)ok | | | | Damping on |
| setdisrate_2.5 | * | 23 | CR | (tab)ok | * | 13 | CR | Set display rate (Hz) |
| setdisrate_5 | * | 183 | | (tab)ok | | | | |
| setunit_perh | * | 5 | CR | (tab)ok | * | 13 | CR | Tendency .../h |
| setunit_permin | * | 225 | | (tab)ok | | | | Tendency .../min |
| | | | | | | | | |
| | | | | (tab)[er] | * | 10 | CR | Error |

**Note:** The character _ indicates a space

## 3.6 Battery change

- Open battery receptacle
- Insert 9 V-alkali battery (IEC 6LR61) or accumulator

Ensure correct polarity!

Correct disposel of the used batteries according to environment regulations!

## 3.7 Recalibration

**Recalibration to be carried out by specially skilled staff only.**

Relevant instructions see in section 8. We recommend to recalibrate the instrument at least once a year.

# 4 Specifications

## 4.1 Technical data

| | |
|---|---|
| Measuring media | instrument air or inert gases |
| Media-compatible types | all media compatible with stainless steel 18/8 (DIN 1.4305) |

| Units | Measuring ranges | | |
|---|---|---|---|
| | up to 7 bar | 10 to 30 bar | 70 bar |
| mbar | x | x | x |
| bar | x | x | x |
| Pa | x | - | - |
| kPa | x | x | x |
| hPa | x | x | - |
| MPa | - | x | x |
| $mmH_2O$ | x | x | - |
| $mH_2O$ | - | - | x |
| mmHg | x | x | - |
| psi | x | x | x |
| $inH_2O$ | x | x | x |
| inHg | x | x | - |

| | |
|---|---|
| Linearity, hysteresis and repeatability | |
| (10 °C to 35 °C) | ± 0,2 % F.S. |
| (50 °F to 95 °F) | (standard) ± 1 digit<br>± 0,1 % F.S.<br>(option) ± 1 digit<br>± 0,05 % F.S.<br>(option) ± 1 digit<br>(according to measuring range) |
| Operating temperature | -5 °C to 50 °C<br>(23 °F to 122 °F) |
| Storage temperature | -20 °C to 60 °C<br>(-4 °F to 140 °F) |
| Humidity | 30 to 95 % rH |
| Case protection class | IP 54 |
| Power supply | 9 V-battery (IEC 6LR61) or accumulator<br>regulated plug-in mains supply unit (7 to 14 VDC) |
| Current consumption | <9 mA |
| Operating time (battery) | appr. 70 h |
| Baud rate RS232 | 9600/4800/2400/ 1200 baud |

| | |
|---|---|
| Measuring rate in RS232- mode | |
| -Class 0,2 | 20 measurements/s |
| -Class 0,1 and 0,05 | 10 measurements/s |
| Measuring rate, | 2 ½ or |
| normal mode | 5 measurements/s |
| Memory capacity | max. 964 measurements |
| Memory interval | manual,<br>1,5,10,20,30,60 s<br>2,3,5,10,30,60 min |
| Display | LCD matrix,<br>2 lines of 16 characters |
| Pneum. ports | hose 4/6 mm or NPT 1/8" |
| Case dimensions | 152x83x34/29 mm |
| Weight incl. battery | 270 g |

## 4.2 Measuring ranges

| Metric Range | | English Range (rounded) | | Max. load capacity | | | | Max. static pressure | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 ... 2.5 | kPa | 0 ... 10 | inH2O | 12.5 | kPa | 50 | inH2O | 700 | kPa | 100 | psid |
| 0 ... 7 | kPa | 0 ... 28 | inH2O | 35 | kPa | 140 | inH2O | 700 | kPa | 100 | psid |
| 0 ... 20 | kPa | 0 ... 80 | inH2O | 150 | kPa | 600 | inH2O | 700 | kPa | 100 | psid |
| 0 ... 30 | kPa | 0 ... 120 | inH2O | 150 | kPa | 600 | inH2O | 700 | kPa | 100 | psid |
| 0 ... 50 | kPa | 0 ... 200 | inH2O | 400 | kPa | 1600 | inH2O | 700 | kPa | 100 | psid |
| 0 ... 100 | kPa | 0 ... 14.5 | psid/g | 400 | kPa | 58 | psid/g | 700 | kPa | 100 | psid |
| 0 ... 110 | kPa | 0 ... 15.9 | psia | 400 | kPa | 58 | psia | -- | | -- | |
| 0 ... 200 | kPa | 0 ... 29 | psia/d/g | 700 | kPa | 100 | psia/d/g | 700 | kPa | 100 | psid |
| 0 ... 700 | kPa | 0 ... 100 | psia/d/g | 1700 | kPa | 245 | psia/d/g | 1700 | kPa | 245 | psid |
| 0 ... 1000 | kPa | 0 ... 145 | psid/g | 2700 | kPa | 390 | psid/g | 2700 | kPa | 390 | psid |
| 0 ... 1700 | kPa | 0 ... 245 | psid/g | 2700 | kPa | 390 | psid/g | 2700 | kPa | 390 | psid |
| 0 ... 3000 | kPa | 0 ... 435 | psig | 7000 | kPa | 1000 | psig | -- | | -- | |
| 0 ... 7000 | kPa | 0 ... 1000 | psig | 14000 | kPa | 2000 | psig | -- | | -- | |

a = absolute pressure
d = differential pressure
g = relative pressure

Conversion factors

| | | | |
|---|---|---|---|
| 1 mbar | = | 0,1 | kPa |
| 1 mbar | = | 0,0010 | bar |
| 1 mbar | = | 10,20 | $mmH_2O$ |
| 1 mbar | = | 0,7501 | mmHg |
| 1 mbar | = | 0,0145 | psi |
| 1 mbar | = | 0,4015 | $inH_2O$ |
| 1 mbar | = | 0,02953 | inHg |
| 1 mbar | = | 1,0 | hPa |

☞ The maximum load capacity applies for relative overpressure and negative pressure. **The instrument is calibrated from 0 to100% of the measuring range.** Exceeding or underrunning this range by up to about 10% is still displayed.

☞ **Differential pressure sensors (d) doesn't measure the same value on the P and S side mandatorily because of her geometry.**

## 4.3 Power supply unit connection

The HM28 can be operated by a regulated plug-in power supply unit.

| | |
|---|---|
| Input | 115V, 60 Hz |
| Output | 9 V DC ± 20 %, 100 mA (7 to 14 V DC) |

# 5 Maintenance

The HM28 requires no maintenance. It can be cleaned with a damp cloth. Do not use cleaning agents containing solvents!
See the relevant chapters for **battery change** and **recalibration**.

## 6 Warning messages and faults

| Fault/indication | Possible cause | Remedy |
|---|---|---|
| ERROR<br>OUT OF RANGE | 10% exceeding or under-running of measuring range | Apply permissible measuring pressure |
| CHANGE BATTERY | Battery voltage too low | Insert new battery |
| No change in measurement | Over pressure applied to pressuresensor | Dispatch instrument for repair |
| Does not switch on | No power supply | Fit new battery as required<br>Battery possibly not correctly inserted<br>Plug in power supply unit correctly |
| Instrument inaccurate | Inaccurate recalibration | Repeat recalibration |
| | Not zeroed | Vent and actuate zero |
| | Natural aging of the pressure sensor | Carry out recalibration |

## 7 Accessories

Standard 1 9 V block battery
1 operating instructions

Option
Plug-in power supply unit
115V, 60Hz
Leather case with carrying strap
Service set
Hand pump with variobellows 5bar
Handpump 20 bar
SCS test certificate
Adapter RS232 9M-25F
Adapter NPT1/8"
Communication SW package
comprising:
- RS232-IF cable (9 pole fem.)
- Communication-software for MS Windows
- Measurement places management software for MS Windows

## 8 Calibration instructions

**Recalibration to be carried out by specially skilled staff only!**
Actuate the following key combinations:

- First press MODE and keep it pressed
- Next and additionally, press CLEAR/ZERO and keep pressed until CALIBRATION is displayed

Exit from this mode is possible at any time via MODE or OFF.
**The instrument must be in operation for at least 30 minutes** (warm up stabilization time)**.**

New calibration values are only stored when **all five setpoints** have been running through correctly and acceptable values acquired. In the event of a maloperation, the calibration process is interrupted and the previous calibration data are retained.

**An incorrect internal instrument temperature can lead to accuracy fluctuations!**

**The pressure set points have to be set in [mbar]!**

**Check the instrument accuracy after recalibration!**

**Calibration at 22 °C (71,6 °F) environmental temperature**

| Calibration Point | Display | Execute | Notes |
|---|---|---|---|
| | CALIBRATION | | |
| 0 % F.S. | CALIB 22 °C<br>SET x mbar | - Set set point x<br>- Press ZERO/CLEAR | 0 % F.S. not available with absolute pressure sensor |
| | OK | | |
| 25 % F.S. | SET x mbar | - Set set point x<br>- Press ZERO/CLEAR | |
| | OK | | |
| 50 % F.S. | SET x mbar | - Set set point x<br>- Press ZERO/CLEAR | |
| | OK | | |
| 75 % F.S. | SET x mbar | - Set set point x<br>- Press ZERO/CLEAR | |
| | OK | | |
| 100 % F.S. | SET x mbar | - Set set point x<br>- Press ZERO/CLEAR | |
| | CALIBRATION OK | | |

**LOVE CONTROLS Division**
**Dwyer Instruments, Inc.**
**Highway 212 AT 12**
**Michigan City, IN 46360**
**USA**
**Phone ++1 219 879 8868**
**Fax ++1 219 872 9057**

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